Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET: Pre-Launch	Problem	FIAR	IFA STS-47-V-01	MPS
None	GMT: 256:07:00:00.000		SPR None	UA	Manager:
			IPR	PR MPS-0247	
					Engineer:

Title: Aft Compartment Hydrogen Concentration High (ORB)

Summary: DISCUSSION: During initial liquid hydrogen fastfill loading operations prior to recirculation pump activation, the aft compartment hydrogen (H2) concentration peaked at 550 ppm (corrected). This violated the 500 ppm H2 concentration Launch Commit Criteria (LCC) limit for OV-105. The concentration dropped slightly during reduced fastfill, and dropped again during topping. After transition to the stable replenish mode, the concentration decayed significantly to 75-100 ppm, below the LCC limit of 150 ppm. Aft compartment H2 concentrations remained below 100 ppm for the duration of loading. These characteristics implied a leak in the low pressure system, and a waiver was written based upon that assumption.

A postflight analysis of four aft compartment hazardous gas (catch bottle) samples taken at various times during ascent revealed that the H2 concentration during ascent was relatively low and well within limits. Postflight troubleshooting was unable to conclusively determine the source of the leak. However, a mass spectrometer leak check showed that the 17-inch disconnect boroscope inspection test port leakage was near the maximum allowable of 1x10-6 sccs. After the corresponding seal was removed and replaced, a leak check showed improvement. Also, torque checks on LH2 inlet and outlet flanges found several bolts in the low pressure system with torques below specifications. The bolts were tightened to specification values. Also, the 4" disconnect was found to be below spec. and has been reshimmed to the high side. CONCLUSION: The increased aft compartment H2 concentration limit violation occurred early in the loading process. As the loading progressed, the LH2 system pressure decreased and the hardware became thermally stabilized, resulting in a decreased H2 concentration. The aft compartment H2 concentration during ascent was normal. Although no conclusive source of the leakage could be determined, the high H2 concentration most probably resulted from minor leakage from one or more joints in the low pressure H2 system. CORRECTIVE_ACTION: The 17-inch disconnect boroscope inspection test port seal will be replaced. The PV4 relief valve seal was replaced as a precaution since it had been disturbed during this flow. Bolts exhibiting torques below specifications were retorqued. A LCC change to raise the allowable aft H2 concentration limit from 500 to 600 ppm is in work. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Pre-Launch	Problem	**FIAR**	**IFA** STS-47-V-02	APU
None	**GMT:** 256:08:45:00.000		**SPR** 47RF04	**UA**	**Manager:**
			IPR	**PR** APU-0055	
					Engineer:

Title: APU 3 Fu Test Line Temperature Low (Prelaunch) (ORB)

Summary: DISCUSSION: Following normal procedures the auxiliary power unit (APU) system A heaters were activated prior to cryogenic loading by ground command. Upon initiation of the cryogenics loading, the aft compartment temperature decreased below the APU 3 fuel test line thermostat lower set point of 55? +/- 5?F, thus requiring the heaters to cycle. The temperature 2 measurement (V46T0384A) reached a minimum temperature of 46?F, which violated the launch commit criteria (LCC) lower limit of 48?F. The LCC limit is derived from the thermostat setpoint, uncertainty, instrumentation error, and difference in location. An LCC waiver/deviation was processed to set the LCC lower limit to 42?F. When the heaters were activated on orbit, the heaters operated normally with constant cycles between 55?F and 75?F.

CONCLUSION: This problem is a recurrence of a problem that occurred on OV-105 during STS-49 (IFA STS-49-V-33). After STS-49, the line insulation, heater wrap, temperature sensors, and thermostats were inspected to verify that the installation was per drawing and functioned properly. Both temperature sensors were found to be installed in the wrong location and temperature sensor 2 had anomalous resistance readings. Both sensors were removed and replaced. The temperature sensor, heater wrap, and insulation were verified to be reinstalled correctly. During STS-47 on orbit heater cycling, the two temperature sensors had identical traces within the expected range. The low temperatures on sensor 2 appear to be a characteristic of its location with respect to the system A thermostat and the poor insulating properties of the line insulation in sea level applications. Thermal and APU engineering are performing a detailed study to determine if any modifications to the heater systems are required to prevent LCC and/or fault detection and annunciation (FDA) violations. CORRECTIVE_ACTION: An RCN is being generated to activate the system B heaters prelaunch instead of the system A. A review of the prelaunch data from previous flights indicates that the localized temperature around the temperature sensor 2 (which is located adjacent to the system B thermostat which it monitors) is slightly colder than the sytem A thermostat. Therefore, system B heaters will have a higher duty cycle and will increase the low peak temperatures. This change will help prevent the LCC violation and FDA limit violations prelaunch. The failure analysis will be conducted under CAR 47RF04-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:09:59.990	Problem	**FIAR**	**IFA** STS-47-V-03	RCS
PROP-01	**GMT:** 256:14:33:00.000		**SPR** 47RF01	**UA**	**Manager:**
			IPR	**PR** LP03-14-0361	
					Engineer:

Title: Thruster L3A Fail-off (ORB)

Summary: DISCUSSION: Reaction control subsystem (RCS) primary thruster L3A (S/N 318) was declared failed-off by redundancy management (RM) at 256:14:33 G.m.t., when it was commanded to fire for the first time of the mission following ET separation. Upon receiving the fire command, the chamber pressure (Pc) increased to a maximum of 8 psia (nominal is 150 psia). RM declared the thruster failed-off after three consecutive Pc readings of less than 36 psia. Injector temperature profiles were nominal indicating that both oxidizer and fuel entered the injector tubes. No attempt to refire the thruster was made during the remainder of the mission.

A postflight boroscope examination of the L3A Pc tube revealed no indication of blockage in the tube. Data analysis of the L3A failure indicates that full fuel flow and only partial oxidizer flow most probably occurred. This is similar to thruster failures on prior missions that were attributed to an accumulation of iron nitrates that impede flow through the pilot stage, preventing the main stage from opening. Iron nitrate formation is accelerated by the reaction of N2O4 with moisture. Nitrate accumulation at the thruster valve can result in degraded performance and component failure. CONCLUSION: The most probable cause of the low chamber pressure reading is a failure of the oxidizer valve main stage to open due to iron nitrate-induced flow impedance in the pilot stage. CORRECTIVE_ACTION: KSC will remove and replace the thruster and transfer it to White Sands Test Facility for the thruster flush program. Failure analysis results will be documented in CAR 47RF01-010.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:01:59.990	Problem	**FIAR**	**IFA** STS-47-V-04	MPS
BSTR-01	**GMT:** 256:14:25:00.000		**SPR** 47RF02	**UA**	**Manager:**
			IPR	**PR** MPS-0243	
					Engineer:

Title: Engine 1 LH2 Inlet Pressure Transducer Fail (ORB)

Summary: DISCUSSION: The engine 1 liquid hydrogen (LH2) inlet pressure reading (V41P1100C) jumped from a normal value (20 psia) to an off-scale low (OSL) value at 256:14:25:23 G.m.t. (0/00:02:23 MET). The measurement remained OSL for the duration of the mission, including entry repressurization. The performance of the engines and all other main propulsion system pressure parameters was nominal during the mission.

Postlanding checks of related wiring and signal conditioning equipment showed no problem. The transducer was removed and sent to Rockwell-Downey for failure analysis. CONCLUSION: The most probable cause of the anomalous pressure reading was a failure of the pressure transducer. CORRECTIVE_ACTION: The pressure transducer was removed, replaced, and sent to Rockwell-Downey for test and evaluation. Final corrective active will be documented in CAR 47RF02-010.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:10:59.990	Problem	**FIAR**	**IFA** STS-47-V-05	HYD
None	**GMT:** 256:14:34:00.000		**SPR** 47RF12	**UA**	**Manager:**
			IPR	**PR** HYD-5-03-0092	
					Engineer:

Title: WSB 1 Overtemp (ORB)

Summary: DISCUSSION: During ascent, water spray boiler (WSB) 1, serial number (S/N) 14 exhibited a delay in auxiliary power unit (APU) 1 lube oil cooling. The APU 1 lube oil temperature reached approximately 280?F before cooling was observed. Once cooling started, the WSB over-cooled to 235?F. WSB 1 eventually achieved sustained cooling around the 250?F set point (+/- 2?F) for greater than 60 seconds, which indicated no controller or spray temperature sensor failure. During entry, WSB 1 lube oil and hydraulic oil cooling performance was nominal.

WSB S/N 14 was installed on OV-104 prior to its first flight. The boiler was flown on two flights of OV-104 with no major cooling anomalies noted. In November 1986, the WSB was found to have extensive shell corrosion. The WSB was removed and returned to the vendor for cleanup and refurbishment, which included a new aluminum shell. The baseline acceptance test procedures (ATP) was performed on the WSB prior to shipment. WSB S/N 14 was installed on OV-105 at Palmdale in late 1990 prior to its first flight. No major cooling anomalies were observed during the first flight: however, a minor over-temperature to 267?F occurred during ascent prior to spray initiation. Normal vendor testing with hot APU lube oil does not exactly duplicate the KSC hot flush and may not be sufficient to flush all the contaminants out of the lube oil tubes. CONCLUSION: The failure of the WSB to adequately regulate the lube oil temperature during ascent most probably resulted from a spray bar freeze-up, since delayed cooling was observed. Cooling indicates acceptable controller and spray valve operation. Wax contamination indicated by differential pressure measurements at the vendor during the last ATP is considered a strong potential contributor to the spray bar freeze-up. Hot oil flushing of the APU lube oil circuitry during turnaround has been encouraging as a remedial measure when the WSB undercooling conditions have occurred on previous flights during ascent. CORRECTIVE_ACTION: The hot oil flush of this WSB has been completed for this flow. In addition, vendor testing will be reviewed and possibly modified to augment the KSC hot flush procedure to ensure adequate flushing of all WSB's. The current WSB/APU integrated study is expected to help in understanding the contribution of the various parameters involved in the WSB undercool. Any further analysis will be conducted under CAR 47RF12-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:01:06:59.990	Problem	**FIAR**	**IFA** STS-47-V-06	PRSD
EGIL-01	**GMT:** 256:15:30:00.000		**SPR** 47RF05	**UA**	**Manager:**
			IPR 54V-0007	**PR**	
					Engineer:

Title: Cryo O2 Tank 4 Heater Control Pressure Measurement Fail Low (ORB)

Summary: DISCUSSION: The cryogenic (cryo) oxygen (O2) tank 4 heater control pressure measurement (V45P1410A) failed to the off-scale-low value of 515 psia approximately 47 minutes after lift-off (256:15:10:23 G.m.t.). The O2 tank 4 cryo controller circuit breaker on panel ML86B was cycled ten times, but the measurement did not recover. This measurement remained off-scale-low throughout the mission until approximately six minutes prior to landing when it returned to a normal reading. It continued to operate nominally after landing.

The O2 tank 4 heater control pressure measurement is used by the cryo pressure controller (CPC) to operate the cryo tank heaters to maintain O2 tank pressure within an 840 to 875 psia control band. With a four cryo tank set configuration such as was being flown this mission, the tank 3 and tank 4 heater systems operate in a paired set. This allows either the tank 3 or tank 4 CPC to operate both tank heaters as long as both heater systems have either the A or B heater switch in AUTO. An on-orbit test was performed to confirm the failure: when the pressures in both O2 tanks 3 and 4 were in the nominal control range and heaters were off (with both heater switches in AUTO), the O2 tank 3 heater switches were positioned to OFF. The tank 4 heaters immediately came on, verifying that the controller was constantly sensing a low pressure signal from the heater control pressure measurement. The O2 tank 4 pressure, sensed by a redundant pressure measurement that does not control the heaters, continued to rise past the nominal heater turn-off point to 921 psia, at which time the tank 4 switches were positioned to OFF. With this failure, O2 tank 4 was unable to be operated independently in the AUTO mode, if the need arose. An additional similar failure for O2 tank 3 would have resulted in the loss of automatic control for both tanks and would have required manual operation of the tank heaters. The heater cycling in O2 tanks 3 and 4 was nominal throughout the mission with tank 3 pressure controlling the heater cycles. Postflight troubleshooting at KSC was unable to repeat or determine the source of the problem. Testing included wiggling wires between the pressure transducer and the cryo control box and verifying the pressure transducer output. CONCLUSION: The O2 tank 4 heater control pressure measurement was reading off-scale low during the on-orbit operations. This did not affect the usage of the tank since tank 4 heater control was maintained by the tank 3 cryo pressure controller. The most probable cause of the off-scale-low reading was a transient open-circuit conditon in the heater control circuitry. CORRECTIVE_ACTION: Since no cause of the anomaly could be identified, and the tank 4 heater is satisfactorily operated by the tank 3 cryo pressure controller should the malfunction recur, no corrective action was taken. Final corrective action will be documented in CAR 47RF05-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: The problem could repeat during next mission of OV-105 (STS-54). This mission will have a four cryo tank set, meaning tanks 3 and 4 will be paired as on STS-47. A worst case scenario, repeat of this anomaly plus an identical problem in the O2 tank 3 heater control pressure measurement, would require manual operation of the O2 tanks 3 and 4 heaters.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:10:59.990	Problem	**FIAR**	**IFA** STS-47-V-07	HYD
MMACS-01	**GMT:** 256:14:34:00.000		**SPR** 47RF13	**UA**	**Manager:**
			IPR	**PR** HYD-5-03-0094	
					Engineer:

Title: WSB 3 No Cooling (ORB)

Summary: DISCUSSION: During ascent, water spray boiler (WSB) 3, serial number (S/N) 15 exhibited no cooling until just prior to the early shutdown of auxiliary power unit (APU) 3. The APU 3 lube oil temperature reached approximately 292?F when the WSB was switched from controller A to controller B. The lube oil temperature continued to climb to 311?F when the decision was made to shutdown APU 3 early. Prior to APU 3 deactivation, the WSB 3 GN2 regulator outlet pressure indicated spraying had started. WSB 3 continued to spray until the spray logic was turned off (total spray time was approximately 1 minute and 43 seconds); however, steady-state cooling was never achieved on controller A or B since the lube oil temperature was not allowed to drop to 250?F prior to boiler spray logic shutdown.

APU 3 was selected to perform the flight control system (FCS) checkout. The FCS checkout timeframe was extended to verify WSB 3 cooling performance. The extended APU 3 runtime demonstrated satisfactory cooling on both controllers. Approximately 3 minutes and 42 seconds after spray initiation on controller B, the WSB was switched to controller A. Controlled cooling on controller A was observed for 1 minute and 47 seconds until spray logic and APU 3 were deactivated. WSB lube oil and hydraulic cooling performance during entry was nominal. WSB S/N 15 was installed on OV-104 prior to its first flight. The boiler was flown on two flights of OV-104 with no major cooling anomalies noted. In November 1986, the WSB was found to have extensive shell corrosion. The WSB was removed and returned to the vendor for cleanup and refurbishment, which included a new aluminum shell. The baseline acceptance test procedures (ATP) was performed on the WSB prior to shipment. WSB S/N 15 was installed on OV-105 at Palmdale in late 1990 prior to its first flight. No cooling anomalies were observed during the first flight (STS-49) of OV-105. Normal vendor testing with hot APU lube oil does not exactly duplicate a KSC hot flush and may not be sufficient to flush all the contaminants out of the lube oil tubes. CONCLUSION: The failure of the WSB to adequately regulate lube oil temperature during ascent could have resulted from failure of a spray valve, controller failure, or freeze-up of the spray bars. Since the spray valve and both controllers were subsequently verified during FCS checkout and entry, spray bar freeze-up remains as the most probable cause. Wax contamination indicated by differential pressure measurements at the vendor during the most recent ATP is considered a strong potential contributor to the spray bar freeze-up. Hot oil flushing of the APU lube oil circuitry during turnaround has been encouraging as a remedial measure when the WSB undercooling conditions have occurred on previous flights during ascent. CORRECTIVE_ACTION: The hot oil flush of this WSB has been completed for this flow. In addition, vendor testing will be reviewed and possibly modified to augment the KSC hot flush procedure to ensure adequate flushing of all WSB's. The current WSB/APU integrated study is expected to help in understanding the contribution of the various parameters involved in WSB undercools. Any further analysis will be conducted under CAR 47RF13-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:03:45:59.990	Problem	**FIAR**	**IFA** STS-47-V-08	FCP
EGIL-02	**GMT:** 256:18:09:00.000		**SPR** 47RF16	**UA**	**Manager:**
			IPR	**PR** FCP-0044	
					Engineer:

Title: Fuel Cell 3 Water Relief Line Temperature Erratic (ORB)

Summary: DISCUSSION: Erratic temperature cycling occurred during the first three days of the mission on the fuel cell 3 water relief valve, the water relief line common to all three fuel cells, and the water relief nozzle. The water relief line temperature (V45T0450A) declined during the first hours of the mission, dropping below the nominal heater-on point of 70?F to 57?F. The fuel cell 3 water relief valve temperature (V45T0432A) concurrently dropped below the nominal heater-on point of 70?F to 64?F. To preclude the possibility of a nuisance Fault Detection and Annunciation (FDA) alarm caused by the low relief line temperature, the normal FDA value of 60?F was changed to 53?F. After approximately three days, all temperatures ceased their erratic behavior. However, the fuel cell 3 relief valve heater cycled at a much higher rate than normal for the duration of the mission.

A small water leak through the fuel cell 3 water relief valve would produce the observed temperature signatures. The leak rate associated with the observed signatures would be negligible and would not impact the mission potable water supply. During prelaunch processing, the potable water system failed a leak check and IPR 47V-0074 was written. The problem was isolated to the fuel cell 3 water relief valve failing to completely reseat and leaking a small amount of water. No leakage was detected when the leak check procedure was repeated, so the IPR was closed. An inspection of the water relief nozzle immediately after landing revealed no evidence of water. Postflight troubleshooting of the fuel cell 3 relief valve showed no leaks or decays. CONCLUSION: The erratic temperature cycles experienced by the fuel cell water relief lines were most probably caused by a small leak in the fuel cell 3 water relief valve, although no data have been obtained to prove it conclusively. CORRECTIVE_ACTION: Due to the fact that the leak was not present during post-flight testing and the leak had negligible effects during the flight, no corrective action was taken. These measurements will be monitored closely during the next flight. Final corrective action will be documented in CAR 47RF16-010.
EFFECTS_ON_SUBSEQUENT_MISSIONS: A repeat of this anomaly may occur on the next flight of this vehicle.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:05:51:59.990	Problem	**FIAR**	**IFA** STS-47-V-09	RCS
PROP-02	**GMT:** 259:20:15:00.000		**SPR** 47RF03	**UA**	**Manager:**
			IPR	**PR** LP03-14-0362	
					Engineer:

Title: RCS Jet L5D Low Chamber Pressure (ORB)

Summary: DISCUSSION: Reaction Control System (RCS) vernier thruster L5D experienced chamber pressure degradation over the course of the mission. The chamber pressure degraded by approximately 7 psi per day from 103 psia (nominal is 110 psia) to 69 psia during the first days of the mission, with some recovery on longer burns. On flight day 4, a 5-second firing of L5D was performed in an attempt to correct the situation. No significant improvement was attained, however. Low vehicle rates confirmed the thruster had degraded performance, and propellant quantity divergence verified the thruster was operating fuel rich. Following the flight day 7 FCS checkout, in which a series of longer duration firings were made, the L5D Pc suddenly increased to nominal values. About 12 hours later, the pressure again began decreasing at a rate of approximately 6 psia per day, and at the end of the mission, the chamber pressure had decayed to 95 psia.

Degraded chamber pressure on the verniers has been seen before in flight, although a steady in-flight degradation has not been seen before. Usually this has been contributed to a build-up of combustion residue in the Pc sense port, resulting in a false low pressure indication, or an accumulation of iron nitrates in the oxidizer valve trim orifice, resulting in an off nominal mixture ratio. The low vehicle rates, combined with a divergence in the oxidizer to fuel quantity, indicated the problem was flow restriction within the oxidizer valve. The pressure drop across the trim orifice in the vernier thruster injector can cause iron nitrate to precipitate out of solution. Nitrate accumulation would affect the flow rate of the oxidizer which would also affect the Pc. Usually a longer duration firing is sufficient to clear the condition and return the thruster to nominal Pc. The reason for the failure of the first long firing to accomplish this is unknown. A post-flight boroscope inspection of the thruster found no contaminant build-up in the Pc sense port. CONCLUSION: The most probable cause of this failure is an accumulation of contamination in one or more small cross-sectional locations in the oxidizer valve, resulting in restricted propellant flow. CORRECTIVE_ACTION: The thruster was removed and returned to the vendor for failure analysis. Final corrective action will be documented in CAR 47RF03-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:00:59.990	Problem	**FIAR**	**IFA** STS-47-V-10	HYD
None	**GMT:** 256:14:24:00.000		**SPR** 47RF17	**UA**	**Manager:**
			IPR	**PR** HYD-5-03-0093	
					Engineer:

Title: WSB 2 Regulator Outlet Pressure Erratic (ORB)

Summary: DISCUSSION: Water spray boiler (WSB) 2 GN2 regulator outlet pressure indicated that the relief valve cracking was high at 36.7 psig; reseat was normal. The valve failed the Operations Maintenance Requirements and Specification Document (OMRSD) in-flight checkout requirement DV58AKO.045 (046), for which the specification is 30.0 to 33.5 psig. The same requirement for WSB 2 during the last flight of OV-105, STS-49, was failed with the same signature and was attributed to the regulator outlet pressure transducer. The transducer was removed and replaced prior to STS-47. The failure analysis on the removed transducer could not repeat the anomaly or isolate the anomaly after teardown of the hardware.

CONCLUSION: The pressure transducer experienced an intermittent failure as indicated by a delayed response that was followed by an instantaneous pressure drop of approximately 8 psi during the cracking timeframe. Analysis indicates the relief valve cannot drop 8 psi in less than 200 milliseconds shown in the data. This failure signature indicates possible contamination of the resistive element inside the pressure transducer that inhibits the brush-arm movement when the pressure changes. CORRECTIVE_ACTION: The troubleshooting of the pressure transducer included the 10 crack-and-reseat cycles of the WSB relief valve with monitoring of the regulator outlet pressure using high-rate data. The testing was unable to reproduce the anomaly. It is recommended to fly-as-is because of the lack of spare units and the inability to reproduce the failure. Further failure analysis will be performed under CAR 47RF17-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Loss of this measurement results in the loss of computations of water quantity both on the vehicle and ground. This measurement is used to monitor water leakage; however, water leakage can be monitored by opening the GN2 shutoff valve and monitoring GN2 supply pressure.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:12:56:59.990	Problem	**FIAR**	**IFA** STS-47-V-11	D&C
INCO-05	**GMT:** 259:03:20:00.000		**SPR** 47RF07	**UA**	**Manager:**
			IPR	**PR** COM-0047	
					Engineer:

Title: The Ku-Band Range Rate/Azimuth Display Failed. (ORB)

Summary: DISCUSSION: The crew reported that the tens digit of the Ku-Band range rate/azimuth digital display on Panel A2 was blank. A lamp test was performed and all the segments illuminated. The loss of the display had no impact on the flight.

Postflight troubleshooting isolated the failure to the display unit in Panel A2. The unit was removed and replaced, and sent to NSLD for failure analysis. CONCLUSION: There was most likely a component failure within the display unit. CORRECTIVE_ACTION: The unit was removed and replaced. Final corrective action will be documented on CAR 47RF07. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 005:00:36:59.990	Problem	**FIAR**	**IFA** STS-47-V-12	MECH, INST
None	**GMT:** 261:15:00:00.000		**SPR** 47RF04	**UA**	**Manager:**
			IPR 54V-0014	**PR**	
					Engineer:

Title: Left-hand Outboard Tire Pressure 1 and 2 Measurements Were Excessively Biased. (ORB)

Summary: DISCUSSION: Since the first use of the tire pressure decay monitoring system (TPDMS) on STS-48 (OV-103), biases have existed between the sensor readings and the actual tire pressures. These biases are attributed to a shift of the sensor's maximum operating output with respect to its maximum design output, and to sensor error.

Approximately two days prior to the launch of STS-47, a revised calibration curve was installed in both the KSC and Orbiter Data Reduction Complex (ODRC) data reduction software to lessen the bias magnitude. The new curve was designed to have each sensor's bias fall within a range of +/- 4 psi. Retrieval of prelaunch data using the new calibration curve indicated that the left-hand outboard (LHOB) tire pressure 1 and 2 measurements (V51P0570A & V51P0572A) had biases outside the +/- 4 psi envelope. The resulting biases were found to be 8.7 psi on sensor 1 and 7.6 psi on sensor 2. All other tire pressure sensors were found to be within the bias envelope. No problems were identified with the creation and implementation of the revised calibration curve. Monitoring and analysis prelaunch and during the flight indicated that the LHOB tire pressure decay rates were stable and that reliable end-of-mission tire-pressure predictions could be made. Postflight mechanical gauge readings confirmed that the LHOB tire pressure decay was nominal (0.14 psi/day @ 70 deg F). The pressure sensor unit (which contains both sensors) was removed, replaced, and sent to Rockwell-Downey for failure analysis. CONCLUSION: The excessive biases seen after the installation of the revised calibration curve on both LHOB tire-pressure sensors were present during the prelaunch period, and can most likely be attributed to a calibration problem with the sensor unit itself. CORRECTIVE_ACTION: The sensor unit was removed and replaced. Final corrective action will be documented on CAR 47RF04. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 006:14:25:59.990	Problem	**FIAR**	**IFA** STS-47-V-13	TPS
EECOM-03	**GMT:** 263:04:49:00.000		**SPR** None	**UA**	**Manager:**
			IPR	**PR** VERT-0175/0176	
					Engineer:

Title: Rudder/Speedbrake TPS Displaced (ORB)

Summary: DISCUSSION: During the STS-47 mission, the crew downlinked video showing a piece of protruding rudder/speedbrake (R/SB) thermal barrier. An analysis of the thermal characteristics of the region surrounding the debonded barrier was conducted during the mission, and the results indicated that this condition did not pose any threat to the Orbiter vehicle either during orbit operations or during entry. The analysis also showed that, even if the thermal blankets surrounding the area of the thermal barrier completely debonded, the temperature of the underlying structure was still well within acceptable limits during entry.

CONCLUSION: A review of photographs taken prior to STS-49 (the first flight of OV-105) showed that the R/SB thermal barrier was protruding at that time. The amount of protrusion did not change during that flight or during STS-47. No damage was done to either the barrier or the surrounding structure during that flight. An inspection of the barrier following the STS-47 flight showed some minor fraying to the barrier, but no other significant damage. CORRECTIVE_ACTION: Prior to the third flight of OV-105 (STS-54) the thermal barrier endcap and a 6-inch detachable section of the barrier will be removed and replaced. These components encompass the full extent of the protrustion. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:22:24:59.990	Problem	**FIAR**	**IFA** STS-47-V-14	FCP
EGIL-03	**GMT:** 264:12:48:00.000		**SPR** 47RF14	**UA**	**Manager:**
			IPR	**PR** FCP-5342	
					Engineer:

Title: Fuel Cell 2 O2 Flowmeter Erratic (ORB)

Summary: DISCUSSION: After having operated nominally during the mission, the fuel cell oxygen flowmeter exhibited erratic behavior approximately 5 minutes prior to landing. From a correct reading of approximately 4.5 lb/hr, the reading suddenly exhibited erratic cycling between 1.3 and 6.4 lb/hr. This behavior lasted over 10 minutes, after which the reading resumed its normal value.

Postflight testing did not repeat or find the source of this anomaly. Although fuel cell flowmeters have experienced frequent failures on previous flights, this failure signature has not been seen before. CONCLUSION: Based on prior experience, the erratic fuel cell 2 oxygen reading was most probably caused by an intermittent malfunction in the flowmeter signal conditioner circuitry. CORRECTIVE_ACTION: None. Due to the low criticality of the flowmeter and the fact that the anomaly could not be repeated, the unit will fly-as-is. Final corrective action will be documented in CAR 47RF14-010 EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:22:49:59.990	Problem	**FIAR**	**IFA** STS-47-V-15	ECLSS
None	**GMT:** 264:13:13:00.000		**SPR** 49RF17	**UA**	**Manager:**
			IPR	**PR** ECL-5-03-0268	
					Engineer:

Title: Humidity Sensor Failure. (ORB)

Summary: DISCUSSION: During the STS-47 mission, the cabin humidity sensor was noted to be indicating a constant reading. This same signature was seen on STS-49, the first flight of the vehicle. After the STS-47 mission, the sensor responded very slowly to the normal humidity excursions and therefore, the sensor was suspect.

Following the failure on STS-49, a humidity test was performed to verify that the sensor was not stuck at a constant reading. When the sensor was able to provide a changing reading, the decision was made to fly the sensor again to evaluate its performance. Following STS-47, the humidity sensor was in the process of being removed from the vehicle when it was noticed that a plastic protective wrap was covering the sensor inlet. The wrap was loose enough that humidity was able to seep through to the sensor, however, the response rate to humidity changes was very slow. The protective wrap was removed, and the sensor was put back in place for the next flight. CONCLUSION: The constant humidity readings were caused by a failure to remove the protective wrapping over the inlet of the sensor that was installed during the manufacture of the vehicle. This protective wrap made the sensor respond very slowly to humidity changes in the cabin. CORRECTIVE_ACTION: The protective wrap has been removed from the sensor and the sensor has received a one-point ambient calibration to verify its proper operation. EFFECTS_ON_SUBSEQUENT_MISSIONS: The protective wrap on the sensor was installed prior to delivery of the vehicle to KSC. KSC has procedures in place to verify that any protective wrap is removed before a sensor is installed. Therefore, it is not expected that this type of failure will occur again on a subsequent flight.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:09:59:59.990	Problem	**FIAR**	**IFA** STS-47-V-16	APU
None	**GMT:** 257:00:23:00.000		**SPR** 47RF06	**UA**	**Manager:**
			IPR 54V-0023	**PR**	
					Engineer:

Title: APU 1 Drain Line Temp 2 Low (ORB)

Summary: DISCUSSION: After the activation of the auxiliary power unit (APU) 1 fuel tank/line/H2O heater systems on-orbit, the APU drain line temperature sensor 2 (V46T0170A) consistently cycled low (47?F) throughout the mission on both A and B systems before the thermostat activated the heater. The fault detection and annunciation (FDA) limit for the temperature sensor is 48?F. The thermostat lower set point is 55 +/- 5?F. A table maintenance block update (TMBU) was uplinked to lower the FDA to 46?F, and no further alarms occurred. This temperature sensor did not violate the FDA during the last flight of OV-105 (STS-49); however, the sensor did show a high and wide cycle band on both the A and B heater systems.

After STS-49, the insulation thickness around the A and B thermostats was measured and found to be out-of-specification. Insulation was added to return the system to print. After STS-47, a visual inspection of the drain line insulation was performed. The diameter of insulation along the drain line was within specification and had no deformations. The insulation was removed and upon further inspection, the thermal shunt from thermostat B was discovered taped to the drain line. The purpose of the thermal shunt is to cold bias the thermostat to the cold spot on the line, which in this case is the line support clamp. The thermal shunt should be installed such that it free-floats between the line insulation and the heater tape on the line. In the discovered configuration, the B thermostat was subjected to a higher heat load, which caused the line and temperature sensors to be colder than normal. Also, the heater around the thermostats was found to be wrapped incorrectly. The temperature sensors and thermostats were found to be installed correctly and the resistance measurements on the temperature sensors were within specification. The heater was removed and rewrapped per print. The thermostats were removed so that the heater could be rewrapped, and they have been reinstalled per print. Temperature sensor 2 was damaged during the ongoing work, and therefore, was required to be removed and replaced. CONCLUSION: The temperature signatures seen on the last two flights of OV-105 are believed to be due to configuration deviations from the design drawings. CORRECTIVE_ACTION: The drain line heater system including the thermal shunt, heater wrap, insulation and thermostat and sensor locations have all been returned to drawing configuration. Any additional failure analysis needed will be performed under CAR 47RF06-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:04:00:59.990	Problem	**FIAR**	**IFA** STS-47-V-17	GN&C
None	**GMT:** 256:18:24:00.000		**SPR** 47RF08	**UA**	**Manager:**
			IPR 54V-0021	**PR**	

Engineer:

Title: -Z Star Tracker Self-Test Failure (ORB)

Summary: DISCUSSION: The -Z star tracker (ST) failed its first two self-tests during post-insertion activation. The failure signature displayed (i.e., the built-in test equipment [BITE] star was never acquired) had not been seen previously on any other Orbiter flight. About 2 hours later, the -Z ST passed the self-test. During a subsequent troubleshooting test later in the flight, the -Z ST again failed the self-test. Although the BITE star was acquired this time, it was not acquired within the specified 2.4 seconds and this is a known failure signature. The troubleshooting test was terminated when the self-test failure occurred. The failed self-tests did not impact normal mission operations at any time, as the -Z ST performed well in its normal operational mode for the entire flight with all star alignments successfully completed.

CONCLUSION: A series of 35 self-tests were performed at KSC after landing, with the tests beginning 4 minutes after ST powerup and continuing at a rate of about one self-test per minute. The results were as follows: o 16 self-tests passed o 7 failed with the built-in test equipment (BITE) star acquired but not within 2.4 seconds o 12 failed with the BITE star not acquired at all The best explanation of these data is that the BITE star position for this particular ST is between scan lines when the ST is in the reduced field-of-view (FOV) mode. When the ST is commanded to a reduced FOV as part of the self-test, the location of the scan lines changes. If the BITE star is in between scan lines in the reduced FOV, the ST may not acquire the star. The location of the BITE star is fixed in the flight software and cannot be changed. CORRECTIVE_ACTION: No corrective action will be taken as the cost of implementing a change in either ST hardware or software is not justified since self-test failures do not impact normal ST operations. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:08:36:59.990	Problem	**FIAR**	**IFA** STS-47-V-18	GFE
None	**GMT:** 260:23:00:00.000		**SPR**	**UA**	**Manager:**
			IPR None	**PR** DR BH230375	
					Engineer:

Title: CCTV D "Jitter" (ORB)

Summary: DISCUSSION: During the STS-47 mission, two problems were noted with the operation of the closed-circuit television (CCTV) camera D. The first problem produced color "jitter" for a short time after power was applied to the camera, and disappeared after the camera warmed up. Secondly, it was noticed that the pan and tilt motion was slow. When operating properly, the pan and tilt motion should be 1.2 degrees/second; however, during the flight the observed motion was between 0.3 and 0.5 degree/second.

Since it could not be determined if the two problems were related, the camera, lens assembly, pan and tilt assembly, and associated cables were removed from the vehicle and returned to the vendor for troubleshooting and repair. The vendor was able to determine that the slow pan/tilt motion was caused by a timing problem in the circuit generating the timing pulses for the pan/tilt unit. This circuit is located in the camera. With the isolation of this problem in the camera, the lens assembly, pan and tilt assembly and the associated cables were returned for use on a future flight. The vendor has been unable to reproduce the "jitter" observed during the flight. Current plans call for additional troubleshooting in a thermal environment chamber. The problem is being tracked by the Flight Equipment Processing Contract (FEPC) DR number BH230375. CONCLUSION: The slow motion observed in the pan and tilt assembly was caused by a timing problem in the circuit that generates the timing pulses for the pan and tilt assembly. The cause of the "jitter" is believed to be a thermal problem within the camera. CORRECTIVE_ACTION: The camera, lens assembly, pan and tilt assembly, and associated cables were removed from the vehicle and returned to the vendor for troubleshooting and repair. Upon isolation of the problems within the camera itself, the other components were returned to flight status. The failed components in the camera will be replaced by the vendor before the camera is returned to flight status. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The affected camera has been removed from flight status.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** 007:22:23:29.990	Problem	**FIAR**	**IFA** STS-47-V-19	C&T
None	**GMT:** 264:12:46:30.000		**SPR** 47RF11	**UA**	**Manager:**
			IPR 54V-0029	**PR**	
					Engineer:

Title: TACAN Bearing Excursion (ORB)

Summary: DISCUSSION: During the approach and landing phase, at approximately 83,000-feet altitude and at an Orbiter roll angle of approximately -40 degrees (i.e., 40 degrees to the left), a 40-degree bearing offset was observed on Tactical Air Navigation (TACAN) 2 that persisted for 13 seconds. The bearing indication then returned to normal, and flight operations were not impacted. 40-degree bearing excursions are not uncommon, but no excursion of this duration has ever occurred previously. TACAN 2 is a new Collins unit.

CONCLUSION: The steep roll angle of the Orbiter at the time of this incident is the most likely cause of the bearing excursion. As a result of the roll angle, the TACAN 2 antenna, which is located on the lower right of the Orbiter, would have been partially obscured. In addition, the antenna would have been receiving a cross-polarized signal since its orientation with respect to the ground station can induce a change in the polarization characteristics of the antenna. These two factors could then combine to produce the 40-degree bearing offset. Postflight checks of the TACAN revealed no unacceptable signal losses, sensitivity changes or bearing errors. Since bearing excursions of this duration have not been seen on any previous flights, the new Collins TACAN units may have a unique characteristic that makes them more susceptible to bearing excursions. CORRECTIVE_ACTION: This TACAN has been removed and replaced, and bench tests will be performed on its line replaceable units to determine the effects of distorted radio-frequency-input signals on the TACAN bearing angle. EFFECTS_ON_SUBSEQUENT_MISSIONS: Similar excursions may be experienced at steep roll angles. TACAN redundancy management (RM) will temporarily remove a unit with a bearing offset from further RM processing and use the data from the remaining two TACANs. If the bearing offset subsequently clears, then RM will automatically add the removed unit back to RM processing. If two units experience similar persistent bearing excursions, however, then RM will fail the good TACAN and use the two with bearing offsets as the "good" TACANs. In this case, the navigation filter edit criteria would not allow the TACAN data to be incorporated into the navigation state. However, the Orbiter navigation function is still accomplished during this flight phase through use of the inertial measurement units.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:09:36:59.990	Problem	**FIAR**	**IFA** STS-47-V-20	HYD
None	**GMT:** 258:00:00:00.000		**SPR** 47RF18	**UA**	**Manager:**
			IPR	**PR** HYD-5-03-0091	
					Engineer:

Title: WSB 1 Regulator Outlet Pressure Leakage (ORB)

Summary: DISCUSSION: All water spray boiler (WSB) GN2 tank high-pressure decay rates on-orbit were within the specification of no greater than 0.3 psi/hr. Also, all of the WSB GN2 regulator outlet low pressure decay rates were within specification; however, WSB 1 GN2 regulator showed a negative rate indicating a possible forward leakage across the regulator. During ground troubleshooting, the WSB 1 GN2 regulator was subjected to a six hour pressure decay check with the upstream GN2 isolation valve open. The regulator passed the decay check with zero increase in the downstream pressure during the required six hour period.

CONCLUSION: One cause of the increase in the regulator outlet pressure could have been the thermal effects on the GN2 line downstream of the regulator to the water tank. A pressure transducer is located on that stretch of line with no temperature instrumentation. However, the GN2 tank data showed a minor increase in temperature during on-orbit operations. Another possible cause of the increase in the regulator outlet pressure could have been transient contamination that was flushed out during entry operation and/or during the troubleshooting. This regulator is a dash 1 configuration which contains nylon pellets to seal the regulator threads between the top and bottom assemblies. There has been some history of these pellets shredding and generating internal contamination. All subsequent configurations utilize loctite to prevent this concern. CORRECTIVE_ACTION: The six hour decay test could not reproduce the in-flight anomaly. It is recommended to fly-as-is and closely monitor this system next flight for any unusual signatures. Any further failure analysis will be conducted under CAR 47RF18-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:21:36:59.990	Problem	**FIAR**	**IFA** STS-47-V-21	ECLSS
None	**GMT:** 264:12:00:00.000		**SPR** 47RF19	**UA**	**Manager:**
			IPR	**PR** ECL-5-03-0272	
					Engineer:

Title: FES Temperature Oscillations. (ORB)

Summary: DISCUSSION: During the mission, several oscillations in the flash evaporator system (FES) outlet temperature were seen after FES start-up on ascent and after the FES checkout prior to the deorbit activities. These temperature oscillations, when severe enough, could cause a shutdown of the FES. However, there were no FES shutdowns caused by temperature oscillations on STS-47. Similar oscillations were seen during STS-49, the first flight of this vehicle. Following STS-49, the primary controller temperature sensors were repacked in an effort to eliminate the temperature oscillations.

After similar temperature oscillations were observed on STS-47, the procedure used to pack the sensors after STS-49 was reviewed. It was discovered that the procedure for packing the sensors on OV-105 was different from the repack procedures used for the rest of the fleet. The OV-105 procedure could in some cases leave a small air gap in the sensor, adding a response delay to the sensor output. As a result, the primary controller temperature sensors have been repacked again utilizing the improved packing procedure. CONCLUSION: The most probable cause of the FES temperature oscillations was a delayed response in the control sensor output caused by an air gap in the sensor. The air gap in the sensors was the result of the vendor using an incorrect packing procedure. The sensors have been repacked, however, the response test following the repacking of the sensors did not yield the expected performance improvement. Another flight is required to determine the improvement, if any, resulting from the repacked sensors. This problem will continue to be tracked by CAR 47RF19. CORRECTIVE_ACTION: All primary controller sensors have been repacked using the improved packing procedures developed by the vendor's field representative. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The temperature oscillations observed on STS-47 did not cause a shutdown of the FES. If the problem has not been corrected by the repacked sensors, or if temperature oscillations occur on a future flight that result in a FES shutdown, the FES may be restarted by simply cycling the power to the FES controller.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 1	**MET:** 007:22:30:29.990	Problem	**FIAR**	**IFA** STS-47-V-22	MECH
None	**GMT:** 264:12:53:30.000		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Orbiter Pulled to Left during Drag Chute Deploy (ORB)

Summary: Discussion: On STS-47, the drag chute deployment was performed as part of Development Test Objective (DTO) 521. STS-47 was the second in a series of phase I tests of the drag chute. STS-49 was the first flight of the drag chute modification with the drag chute deployment occurring at nose gear touchdown.

Weather at the landing site was observed at the time of landing to be: temperature 83 ?F, winds from 270? true at 2 knots, and barometric pressure of 20.06 in Hg. Upon landing at KSC runway 33, the drag chute was deployed post-main gear touchdown with the nose wheel off. The drag chute was deployed at 172 knots equivalent airspeed (KEAS) and at an angle of attack of approximately 6?. The drag chute reefed position was directly behind the vehicle. When the drag chute disreefed it had excursions of up to 7.75? +/- 2.25? starboard. During the initial phase of the drag chute disreef, the Orbiter was at 145 KEAS and a negative 1-degree angle of attack. As the chute disreefed, the chute moved to a heading angle approximately 8? to the starboard side of the vehicle. This chute offset resulted in a 27-foot left lateral excursion of the vehicle from centerline. As the vehicle slowed, the aircraft was derotated to nose gear touchdown at 134 KEAS with the drag chute position remaining starboard of the vehicle. The crew reported that this condition was very controllable and constant. The DTO-521 is designed to evaluate the basic drag chute performance through a series of landings with increasing deployment speeds using all vehicles. However, expansion of the deployment envelope would only occur after a successful series of OV-105 flights; OV-105 is the only vehicle equipped with drag chute load measurement specific instrumentation. However, a non-instrumented vehicle can and is planned to be used to duplicate any instrumented flight. The original DTO was broken into two phases. The DTO has been revised and is now broken into three phases. Phase I has been completed with the chute modification and test flights, clearing the fleet for unrestricted nominal operations (Initiation at derotation); STS-61 completed the phase I testing. Phase II of the revised DTO scheduled consists of five additional flights gradually increasing in speed from initiation at derotation [175 knots equivalent airspeed (KEAS)] to initiation at 195 KEAS. During phase III, the speed brake position will be decreased from full open to 15? at 195 KEAS in 3 sequential flights beginning at 40?. Phase II is intended to add to the basic understanding of the system performance, which may result in expanding the operational envelope and decreasing the placard restrictions. Phase III will continue to acquire aerodynamic data to better define models for early deployment with closed speed brakes which will support abort usage, flight rules and training. The following actions were taken to better understand the drag chute offset phenomena. A parachute working team was convened. The 4 percent scale vehicle wind tunnel data were reviewed; the B-52 development tests were reviewed; the analytical predictions were reviewed; and the STS-49 and STS-50 (uninstrumented) drag chute deployment data were reviewed (nose gear down disreefing data.) The conclusion derived by the working group focused on increasing the chute stability through an increase in effective porosity. A test and evaluation plan was developed to test the chute in a permanently reefed configuration, and a wind tunnel test plan was developed that would include 2 reefed configurations and multiple ribbon removed configurations. The results of these wind-tunnel tests were that the best stability (+/- ~1? offset for the “ 5 ribbon out” –vs- +/-~ 7? offset for the baseline) with the lowest loss of drag (7% as compared to a reefed chute loss of 20%) was the “5 ribbon removed” configuration. Tow Shuttle flights were flown with a 90 percent reef chute (STS-56 and 57). Each flight had minimal crosswinds (1-2 kts) with drag chute deployment occurring at 158.8 KEAS on STS-56 and 173.7 KEAS on STS-57. The disreefing occurred at 128.8 KEAS for STS-56 and 139.4 KEAS for STS-57. The maximum disreef offset was ~4.0 +/- 2?. Three Shuttle flights have been flown with a 5”5 ribbon removed” configuration. Each flight had minimal crosswinds (1-2 kts) with drag chute deployment occurring at 162.0 KEAS for STS-51, 163.3 KEAS for STS-58, and 168.5 KEAS for STS-61. The disreefing occurred at 138.7 KEAS for STS-58 and 143.3 KEAS for STs-61. The maximum disreef offset angle was ~4.0? +/- 1.0?. Conclusion: The orbiter pulled to the left during drag chute deploy resulting from the drag chute offset to the starboard side of the vehicle after disreef. The drag chute offset and stability was corrected by increasing the chute porosity through the removal of 5 ribbons. Corrective Action: Increase the chute porosity through the removal of 5 ribbons. Continue through the Development Test Objective. Effects On Subsequent Mission: None. The chute is clear for unrestricted nominal operations.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** 003:09:36:59.990	Problem	**FIAR**	**IFA** STS-47-V-23	C&T
None	**GMT:** 260:00:00:00.000		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: AG1/AG2 Crosstalk (ORB)

Summary: DISCUSSION: During the mission, the crew noticed some crosstalk between the air ground 1 (AG1) to AG2. The crosstalk resulted in the crew being able to hear the AG1 voice as a very faint background noise on the AG2 channel. The crew stressed that the crosstalk did not impact mission operations.

CONCLUSION: This condition was not observed on the previous flight of OV-105 (STS-49). The presence of a Spacelab module on this flight, and the use of Spacelab audio, may have been a causative factor. CORRECTIVE_ACTION: The audio channel will be closely monitored during the next flight of this vehicle (STS-54). Since this flight does not have a Spacelab module, it will provide an additional data point for analysis of this problem. An analysis of audio subsystem schematics is also in work to determine if any incompatibilities exist between the Orbiter and the Spacelab. In addition, the audio distribution system unit at JSC/Bldg. 44 is being used in an attempt to duplicate this problem. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The crosstalk that occurred was described as very faint and did not impact operations.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:09:36:59.990	Problem	**FIAR** BFCE-023-F-010	**IFA** STS-47-V-24	GFE
None	**GMT:** 261:00:00:00.000		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Galley Package-in-Place Switch. (GFE)

Summary: DISCUSSION: The crew reported that the package-in-place switch on the Shuttle Orbiter Repackaged Galley (SORG) would not properly reset the dispense cycle when a package was removed and a new one inserted. Manually pulling the lever back did not correct the problem. However, "snapping" the lever by pressing it in, and then quickly releasing it did reset the dispense cycle. The problem was first noticed on the second day of the flight, and became worse as the mission progressed. The galley was removed from the vehicle and returned to JSC for troubleshooting.

During the STS-50 galley debriefing, the crew commented that sometimes the needle would push an extended duration Orbiter (EDO) food pouch out of the adapter rather than puncturing it. As a result of these crew comments, a modification was made to the beverage adapter adding two package retention pins that hold the EDO food packages firmly in place. With the concurrence of the STS-47 Commander, the modified beverage adapter was flown on STS-47, even though the crew had already received their galley training using the unmodified beverage adapter. Some of the crew members, unaware of the change to the beverage adapter, did not properly insert food and beverage packages into the rehydration station early in the mission. This resulted in several 8-ounce water dispenses into the area of the SORG's rehydration station instead of into the drink packages. Some of this water migrated into the package-in-place switch. The problem was duplicated at JSC. Disassembly of the package-in-place switch assembly revealed that a layer of sediment had formed on the stop for the level mechanism preventing the package-in-place switch lever from returning completely. After removing this sediment, the package-in-place switch assembly functioned properly. CONCLUSION: The failure of the package-in-place switch was caused by a layer of sediment deposited on the lever mechanism portion of the switch. The sediment deposited on the package-in-place mechanism was caused by the water from the improper water dispenses. CORRECTIVE_ACTION: The package-in-place switch assmebly has been cleaned, relubricated, and verified to be functioning properly. Flight crews scheduled for flights after STS-47 have been trained with the modified beverage adapter. EFFECTS_ON_SUBSEQUENT_MISSIONS: This type of failure should not affect subsequent missions as all flight crews will have had an opportunity to train with the modified beverage adapter. Should an improper water dispense occur with free water reaching the lever mechanism and cause corrosion, SORG operation can be maintained by cycling the power to the galley between each dispense to reset the dispense cycle.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** -001:23:56:59.990	Problem	**FIAR**	**IFA** STS-47-V-25	GFE
None	**GMT:** 256:14:20:00.000		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: MS3 LES O2 Hose. (GFE)

Summary: DISCUSSION: During the STS-47 launch countdown, after the side hatch was closed and before T-2 minutes in the countdown, the oxygen (O2) supply hose for Mission Specialist 3 (MS-3) in seat 5 became disconnected from the launch/entry suit (LES). The disconnection occurred at the interface between the supply hose and the LES. After trying unsuccessfully to reach the hose, MS-3 decided that in the event of an emergency, the emergency oxygen supply could be used. As a result, MS-3 choose to go through ascent with the helmet visor up.

The breakaway quick disconnect (QD) is designed to work with a pull force of 18 +/- 2 pounds. The female breakaway QD was checked after the flight at KSC and found to have a breakaway pull force of 20 pounds. The female QD was returned to JSC where it was mated with the male half and pull tested and found to be within the specified limits. During ingress operations, the O2 hose is connected and tested by a LES suit technician. Some slack is provided to allow the crewmember some freedom of movement. The amount of slack provided is determined in real-time by the ingress technician and each crewmember. The hose connections are given a final check by the astronaut support personnel (ASP). CONCLUSION: The actual cause of the disconnection cannot be determined. The most probable cause is that crewmember movement possibly combined with a lack of slack in the hose provided enough breakaway force to disconnect the hose. CORRECTIVE_ACTION: The ingress checklist has been modified so that the suit technicians route the O2 hose through an elastic keeper on the lap-belt harness. This change keeps the O2 hose within easy reach should it become disconnected from the suit. This procedure was used for STS-52. EFFECTS_ON_SUBSEQUENT_MISSIONS: With the new ingress checklist procedure in place to keep the O2 hose within easy reach of each crewmember, the effects of a disconnected O2 hose will be avoided on future missions. Each crew member will be able to reconnect their own O2 hose should the hose become disconnected.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Post-Landing	Problem	**FIAR**	**IFA** STS-47-V-26	TPS

None **GMT:** Post-Landing **SPR** 47RF15 **UA** **Manager:**

IPR FWD-5-03-0452 **PR**

Engineer:

Title: Chin Panel Thermal Effects (ORB)

Summary: DISCUSSION: An excessive gap between the nose cap expansion seal and the V070-399441 gap filler was discovered after landing. The gap width was 0.093 inch, which is much larger than the previous flight experience of 0.047 inch on OV-104. After the previous flight of OV-105, STS-49, the gap width was measured at 0.074 inch. The chin panel was removed and the gap filler was replaced prior to STS-47.

CONCLUSION: The gap width and depth is much larger than flight experience has shown on OV-102 and OV-104. The design and certified gap width is zero. Gaps up to 0.047 inch have been flown. If the 0.093 inch gap were to be flown, increased flow into the chin panel assembly and increased heating would occur. Thermal analysis shows that increased heating would cause excessive reinforced carbon carbon (RCC) surface temperatures within the gap. The possible cause of the large gap experienced on OV-105 may be the gap between the chin panel and the nose cone. The gap between the chin panel and nose cone on OV-105 is slightly larger than the gaps on OV-102 and OV-104; however, the gap is within specification. The slightly larger gap increases the gap filler heating, this combined with gap excursions due to RCC expansions and contractions creates larger gaps. CORRECTIVE_ACTION: The removal of the chin panel is complete and gap filler removal and replacement has begun. The gap filler material is being changed from Nextel 312 to Nextel 440 and the Orbiter mold line (OML) sleeving (the gap filler exterior material) fill density is being changed from 3 to 6 pounds per cubic foot. The material changes should reduce the amount of gap growth on subsequent flights. The failure analysis will be conducted under CAR 47RF15-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The proper gap is verified prior to flight. Excessive gap after a mission is a reflight issue.